## A Template for Problem-Solving

To be an effective problem solver:

1) Figure out, and regularly re-articulate, your goals, purposes, and needs. Recognize problems as obstacles to reaching your goals, achieving your purposes, or satisfying your needs.

2) Wherever possible take problems one by one. State each problem as clearly and precisely as you can.

3) Study the problem to determine the "kind" of problem you are dealing with. For example, what do you have to do to solve it?

4) Distinguish problems over which you have some control from problems over which you have no control. Concentrate your efforts on problems you can potentially solve.

5) Figure out the information you need to solve the problem. Actively seek that information.

6) Carefully analyze and interpret the information you collect, drawing reasonable inferences.

7) Determine your options for action. What can you do in the short term? In the long term? Recognize your limitations in terms of money, time, and power.

8) Evaluate your options, determining their advantages and disadvantages.

9) Adopt a strategy. Follow through on it. This may involve direct action or a carefully thought-through wait-and-see approach.

10) When you act, monitor the implications of your action. Be ready to revise your strategy if the situation requires it. Be prepared to change your analysis or statement of the problem, as more information about the problem becomes available.

 

# Problem Solving Rubric

## Understanding the Problem

**5** Complete understanding of the problem

**3** Part of the problem misunderstood or misinterpreted

**1** Complete misunderstanding of the problem

## Planning a Solution

**5** Plan could have led to a correct solution if implemented properly; multiple plans considered

**3** Partially correct plan based on part of the problem being interpreted correctly; only one plan considered

**1** No attempt, or totally inappropriate plan

## Solving the Problem

**5** Correct answer and correct label for the answer

**3** Copying error; computational error; partial answer for a problem with multiple answers

**1** No answer, or wrong answer based on an inappropriate plan

## Reflecting on Problem/Solution

**5** Checks work for accuracy. Identifies whether or not there are errors in the problem, plan, or solution and corrects them.

**3** Checks work for accuracy, but needs guidance to make corrections

**1** Doesn't check work

# Problem Solving Rubric

| Scoring Criteria<br>**(improve critical thinking skills through instruction incorporating inquiry, analogy, inference, induction, deduction, analysis, synthesis, and evaluation)** | **Excellent**<br>**4** | **Good**<br>**3** | **Needs Improvement**<br>**2** | **Unacceptabl**<br>**1** |
|---|---|---|---|---|
| **Identifies a problem:**<br>- Originality and quality of idea, appropriate level<br>- Independent and dependent variables<br>(inquiry, analogy) | | | | |
| **Provides a solution:**<br>- Logical Cause and Effect identified<br>(inference) | | | | |
| **Identifies a workable solution:**<br>- General outline provided<br>(induction, deduction) | | | | |
| **Uses research data:**<br>- Thorough research to provide adequate introduction to the problem is summarized<br>- Two or more major sources provided and relevant information highlighted<br>(analysis) | | | | |

| | | | | |
|---|---|---|---|---|
| **Develops a creative and innovative approach to solve a problem.** (synthesis) | | | | |
| **Collaborates with others in reaching the solution, if applicable.** | | | | |
| **Organizes the solution.** (evaluation) | | | | |
| **Delivers the solution.** | | | | |
| **Presents the solution in an innovative way.** | | | | |

# Problem Solving and Self Evaluation

| | Not Begun | Introductory Instruction | With Guidance | Increasing Independenc | Independent Level |
|---|---|---|---|---|---|
| **Approach to Problem** | | | | | |
| Reads and interprets problems thoroughly before proceeding to solve problem | | | | | |
| Approaches problem in systematic manner: Clarifies the question, identifies needed data. | | | | | |
| Develops and uses a plan | | | | | |
| **Use of Strategies** | | | | | |
| Makes use of the problem solving technique being taught | | | | | |
| Brainstorms at least five ideas that could be used to solve a selected problem | | | | | |
| Evaluates the alternatives to determine the most effective in solving a problem | | | | | |
| Selects effective strategy to solve problem | | | | | |
| Shows flexibility in drawing upon other strategies | | | | | |
| **Finding Solutions** | | | | | |
| Perseveres in problem solving attempts | | | | | |
| Selects another strategy to use when stuck | | | | | |
| Evaluates information and progress, making adjustments as needed | | | | | |
| Considers the reasonableness of a solution for the problem | | | | | |
| Uses a set of criteria to self-evaluate work | | | | | |
| Makes corrections and improvements as needed | | | | | |
| **Communication of Solution** | | | | | |
| Provides clear, sequential, and detailed explanations of processes and solutions in oral form | | | | | |
| Provides clear, sequential, and detailed explanations of processes and solutions in written form | | | | | |
| **Extension of Problem Solving** | | | | | |
| Experiments or suggests new problems | | | | | |
| Makes connections between problems and other applications | | | | | |

# The Problem Logs

There are seven Problem Logs, many with several parts. Each Problem Log features specific thinking skills, as listed below in Overview of Thinking Skills in the Problem Logs.

Note that some of the Problem Logs contain directions for three pathways students can follow through portions of the activity. See pages 20–2 for an explanation of the three pathways.

**Overview of Thinking Skills in the Problem Logs**

| Problem Log Number | Thinking Skills |
|---|---|
| 1 | **Students will:**<br>• Construct relevant questions for inquiry<br>• Distinguish fact from fiction and opinion<br>• Distinguish relevant from irrelevant facts<br>• Evaluate the reliability of information<br>• Construct reasonable inferences (hunches)<br>• Self-regulate thinking processes |
| 2 | • Evaluate the reliability of information<br>• Recognize relevant information<br>• Take accurate notes<br>• Write an accurate, logical summary of information<br>• Write with clarity and precision<br>• Self-regulate thinking processes |
| 3 | • Write an accurate, logical summary of information<br>• Compare facts for agreement and contradiction<br>• Classify facts or ideas by categories<br>• Acquire data accurately through listening |
| 4 | • Define a problem precisely<br>• Establish criteria for solutions<br>• View issues from multiple perspectives<br>• Identify possible consequences |

| Overview of Thinking Skills in the Problem Logs *(continued)* | |
|---|---|
| **Problem Log Number** | **Thinking Skills** |
| 5 | **Students will:**<br>• Self-regulate thinking processes<br>• Analyze the meaning of words<br>• Compare and contrast methods<br>• Use criteria to make judgments<br>• Recognize relevant information<br>• Evaluate information for reliability<br>• Write an accurate, logical summary of information<br>• Write with clarity and precision |
| 6 | • Generate diverse ideas for solutions<br>• Identify potential consequences<br>• Use criteria for selecting ethical solutions |
| 7 | • Self-regulate thinking processes |

Adapted in part from: Carpenter, Helen McCracken. *Skill Development in Social Studies. Thirty-Third Yearbook of the National Council for the Social Studies.* Washington, D.C.: National Council for the Social Studies, 1963; and The Center for Critical Thinking. Strategies. Retrieved November, 2000. http://www.criticalthinking.org/k12/k12class/strat/stratall.html

# Problem Solving Rubric

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| | | | | |
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| **Collaborates with others in reaching the solution, if applicable.** | | | | |
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| **Delivers the solution.** | | | | |
| **Presents the solution in an innovative way.** | | | | |

SOLVING PROBLEMS Rubric

1 = Weak 2 = Moderately Weak 3 = Average , 4 = Moderately Strong 5 = Strong

Student first determines the facts of a problem.

1 2 3 4 5

Student next determines what additional information is needed to understand it.

1 2 3 4 5

Student develops reasons to support answers and also reasons to refute answers.

1 2 3 4 5

Student assesses supporting and refuting reasons to identify most persuasive answers.

1 2 3 4 5

Student makes a decision about the problem based on the answers.

1 2 3 4 5

Student evaluates potential consequences of his or her decision before implementing.

1 2 3 4 5

Student's problem solving employs the appropriate information or facts.

1 2 3 4 5

Student's problem solving shows understanding of concepts or topics in unit of study.

1 2 3 4 5

Student's solution is presented in a clear, concise, and appropriate manner.

1 2 3 4 5

Overall, student's solution demonstrates his/her full potential in applying this skill.

1 2 3 4 5

**Figure 5.2** Characteristics of Various Levels of Success for Inquiry Assessments

**Advanced (Extended/Sophisticated)**

- Is able to make new generalizations from prior experience
- Successfully experiments to create multiple solution paths
- Sophisticated, complex, and detailed explanation of inquiry process and the strategies used

**Proficient (Satisfactory/Adequate)**

- Demonstrates good comprehension of problem situation
- Able to create a successful strategy or solution path
- Able to describe the inquiry process and strategy used

**Basic (Elementary/Partial)**

- Demonstrates some awareness and comprehension of problem situation
- Weak, disorganized explanation of strategy or solution path
- Incorrect or inadequate description of the inquiry process or strategy used

**Novice (Beginning/Minimal)**

- Demonstrates limited awareness and poor assessment of problem situation
- Inadequate and disorganized approach to problem situation
- No clear strategy or inquiry plan

SOURCE: Adapted from rubric in *Brain-Compatible Assessments* by Diane Ronis. © 2000 Corwin Press. Reprinted with permission of Corwin Press.

**Figure 5.3** Problem-Based Learning Evaluation Rubric

| Criteria | Novice = 1 | Basic = 2 | Proficient = 3 | Advanced = 4 |
|---|---|---|---|---|
| **Research quality** | Numerous inaccuracies with little if any detail | Inconsistent accuracy but some level of detail | Accurate and competent with relevant detail | Highly accurate and sophisticated with explicit detail |
| **Strategies used** | At least one acceptable strategy attempted | At least one acceptable strategy correctly applied | Several high-quality strategies applied | Numerous complex and sophisticated strategies applied |
| **Organization of research** | Confusing and clumsy organization | Simple but acceptable organization | Reflective organization demonstrates solid planning | Intuitive organization displays complex and perceptive thinking |
| **Communication** | Ineffective and vague | Superficial quality may lead to some confusion | Competent and effective communication | Precise and nuanced communication shows high level of sophistication |
| **Comprehension** | Little if any understanding demonstrated | Limited, superficial understanding demonstrated | Demonstrations of accurate and thoughtful understanding | Numerous demonstrations of profound and perceptive understandings |
| **Collaboration** | Little evidence of collaboration | Intermittent displays of collaboration | Thoughtful collaboration demonstrated | Highly effective and synergistic collaboration |